

suddenly alter its habits when placed on another host B to which it is not yet attuned, and consequently fails to infect B. But, as Marshall Ward showed, the host B may be merely a closely related variety of A, whence we must infer that the differences of food-material and so forth may be very small, and it is not surprising that occasionally a spore from A may succeed in infecting B, possibly when the latter is "off its guard," as it were, and short of its supplies of resistant materials or unduly lavish of its stores of attractive substances, or possibly because the spore in question happens to be better equipped than usual with the necessary solvents or poisons needed to break down the normal resistance of B. Be this as it may, once the fungus of A has gained a hold on B, it can now go on infecting B by means of its spores—it has now adapted itself to B.

But Marshall Ward showed that, while the fungus on A may fail to infect B, it may be readily able to infect a third related variety of host-plant C, and after adapting itself to C it may then pass easily to B; thus C becomes a bridging form from A to B.

Klebahn in sections xiv. and xv. discusses these matters, and the gradations of specific variation and their bearing on the theory of descent at great length, and concludes,

"The manifold characters of the existing biological species and races appear to have come into being owing to the alternating extensions and restrictions of the area of nutritive plants. These changes, and especially the restrictions of area, have been influenced by adaptation and selection, but many observations indicate that internal developmental tendencies, as yet entirely unexplained, have also played a part in determining the direction of the evolution."

Not much is gained by the latter phrase, but it at least shows the lines along which the thoughts of modern pathologists are tending.

Section xvi. deals with the question of the origin of heteroecism. Klebahn appears to doubt whether the increase of virulence said to be exhibited by *Æcidium* spores from barberry, as contrasted with uredo-spores grown on the wheat itself, can be maintained, and inclines to the belief that an advantageous utilisation of the periodic phenomena of vegetation is rather the key to the problem.

The author then proceeds to the discussion of pre-disposition, and accepts Marshall Ward's researches showing that anatomical peculiarities on the part of the host-plant do not explain it, concluding that in part chemical constitution, in part forces or factors of unknown nature in the protoplasm, are at the bottom of the question.

The concluding section of this part concerns the spermogonia, and views as to the alleged sexuality of the rust-fungi. The view is maintained that the spermatia are now functionless, and the author doubts the sexual character ascribed by Sappin-Trouffy and Dangeard to certain nuclear fusions in the development of teleutospores.

Part ii. is essentially a work of reference for investigators, and deals very thoroughly with all the special points in the biology of the various species of heteroecious Uredineæ raised by the Tulasnes, De Bary,

Dietel, Fischer, Magnus, Eriksson and Henning, Marshall Ward and other workers, including—by no means the least important—the author himself.

A very complete account is given of Eriksson's work on the rusts of the cereals, and of that of Marshall Ward on the brome rusts, and it is probably not too much to say that a more thorough and masterly work on the subject has never yet been produced.

That Klebahn's work will have a wide influence in furthering investigation into these extraordinary and important parasites cannot be doubted.

A STUDY OF RABIES.

Rabies: its Place among Germ-diseases and its Origin in the Animal Kingdom. By David Sime, M.D. Pp. xii + 290. (Cambridge: University Press, 1903.) Price 10s. 6d. net.

THE admiration with which we must regard Pasteur's studies on rabies is increased by the fact that the actual microbe which causes the disease is unknown. Pasteur, nevertheless, by a logical application of the facts known concerning other pathogenic microbes, triumphed over this difficulty, and presented the world with a method of preventive inoculation against hydrophobia. He owed this achievement to the rigid and laborious series of experiments with which he was scrupulously careful to control his theories.

It is strange that Dr. Sime, with this example constantly before his eyes, should have been absolutely blind to its lesson. Anyone who seriously proposes to add to our knowledge of rabies must follow Pasteur's methods. No advance is likely to be made by the most ingenious reasoning unsupported by practical demonstration; we have no use at all nowadays for armchair pathology. Dr. Sime's work is beautifully printed and written in excellent English; it bears evidence of very wide reading and of careful though fanciful thought. But it is wordy to an exasperating degree, and the perpetual use of inverted commas and italics becomes almost a nightmare. There is no evidence from first to last that the writer has attempted to substantiate any one of the remarkable views which he sets forth by a single practical experiment.

There is room in the English language for a good monograph on rabies, but instead of giving a plain and straightforward account of what is at present known about the disease, which it is probable that Dr. Sime would have been competent to do, he presents us with a "study" of rabies from a number of theoretical standpoints, at times embroidered with excursions into transcendental bacteriology. It must suffice here to give a few examples only of the strange views supported by the author. The discussion as to the order of germ-diseases to which rabies belongs is based on a classification with which we are unfamiliar. Dr. Sime sharply divides infective diseases into two groups—those which protect against future attacks and those which do not; for these he employs the singularly unhappy names "prophylactic" and "preventive" respectively. Why a disease which does not protect should be called "preventive" is not

explained, nor does it much matter; every degree of protection can be traced amongst infective diseases, and no such sharp distinction exists as that set forth by Dr. Sime. We learn that the rabies microbe is strictly "preventive," and in the course of the argument much stress is laid upon a misleading analogy between the rabies virus and alcohol—a mistake which might have been avoided had the author's studies included Ehrlich's work on the fundamental differences between such a poison as alcohol and the bacterial toxins which contain a haptophore atom-group.

A chapter is devoted to proving the "multiform structure" of the rabies microbe, illustrated by diagrams as fanciful as the speculations upon which they are based. In a chapter on rabies of the sympathetic system, the virulent character of the saliva in paralytic rabies is explained on the theory that the salivary glands are invaded through the sympathetic nerves. Inasmuch as stimulation of the sympathetic checks the secretion of the submaxillary gland, while stimulation of the chorda tympani excites it, we fail to follow the line of reasoning. In any case Dr. Sime should have put his views to the test by laboratory experiment. But perhaps the high-water mark of irresponsible speculation is reached in the chapter on the relation of bacterial agency to secreting organs, in which the novel view is propounded that not only poisonous secretions in animals and plants, but even digestive secretions owe their existence to a bacterial commensalism in the tissues. As regards the origin of rabies in the animal kingdom, Dr. Sime doubts its primitive canine source, and is inclined to trace it to the "intensifying" division of animals, and in particular to the rabbit, which, exhausted by being hunted, contracts the disease in some unexplained manner from the soil, especially when its ears are frost-bitten. We fear that we must regard this book as an example of the unscientific use of the imagination, and we should not have devoted so much space to it had it not been issued by the Cambridge University Press.

MINING AND QUARRYING.

The Elements of Mining and Quarrying. By Sir C. Le Neve Foster, D.Sc., F.R.S. Pp. xviii+321. (London: Charles Griffin and Co., Ltd., 1903.) Price 7s. 6d. net.

ONE of the most difficult tasks in the field of technical literature is the preparation of a thoroughly good elementary text-book of an industrial art, and the difficulty is especially conspicuous when the subject dealt with is mining, with its incursions into mathematics, physics, chemistry, geology, mineralogy, civil engineering, mechanical engineering, electrical engineering, law, and sanitary science. It is not astonishing that the task has not hitherto been attempted. In French and German there are several useful works of the kind; but in English, elementary text-books have dealt exclusively with but one branch of the subject, the best example being the rudimentary treatise written a generation ago for Weale's series by the late Sir Warrington Smyth.

In 321 pages the late Sir C. Le Neve Foster has NO. 1800. VOL. 69]

covered the whole range of mining and quarrying. With an intimate knowledge of his subject, he combines great clearness of style and a thorough grasp of the beginner's needs. Superfluous detail is carefully avoided, and the arrangement of the matter is eminently logical. Each of the sixteen divisions of the subject is concisely expressed by a single word:—(1) occurrence, (2) discovery, (3) boring, (4) excavation, (5) support, (6) exploitation, (7) haulage, (8) hoisting, (9) drainage, (10) ventilation, (11) lighting, (12) access, (13) dressing, (14) legislation, (15) health, and (16) accidents. These easily remembered headings serve as pigeon-holes in which a student may file his notes upon any mine or quarry he visits. Into this comprehensive system, subjects from widely different fields of science and technology are combined by the author, with the result that his text-book forms, without undue burden of references, a thoroughly trustworthy guide for the beginner in mining, and in many respects for the experienced miner, who is apt too often to specialise in one branch of mining and to ignore the progress made in other branches. The beginner is wisely urged to deal with the subject broadly, and not to confine himself to the narrower sphere of the coal-miner or of the seeker for ores. After mastering the general principles of his art he can specialise later.

This has always been the method of teaching adopted at the Royal School of Mines. Half a century ago Sir C. Le Neve Foster's predecessor in the chair of mining expressed the view that he would never dissociate entirely the art of working collieries from that of working metalliferous mines, since both had much in common, and the one might often profitably borrow an idea from the other. He thought, however, that in the various districts where schools in the future might be established it would be needful to devote more attention to one department than to another, and according to the opportunities of the teacher to select special portions for fuller and more practical instruction. The success of the broad treatment adopted at the Royal School of Mines is clearly shown by the large number of associates of that institution that are occupying positions of eminence in the divergent fields of coal, ore, and precious stone mining in all parts of the world, and by the fact that at the provincial educational institutions of more recent formation the specialised mining instruction is, almost without exception, in the hands of old students of the parent school.

One of the original features of Sir C. Le Neve Foster's book is that he insists that from the very outset the student should seek to acquire some information concerning the laws regulating mining and concerning the diseases and accidents incidental to the miner's calling. This new departure deserves warm commendation. Mining differs from most other occupations by being regulated by special statutes, and with an uncongenial branch of the subject like law the student needs special help. The labour question, too, is of so much importance and often so much more difficult to solve than the extraction of mineral from the ground, that the student cannot fail to be grateful